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THE ALPS

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CENTRAL TOPICS IN GEOGRAPHY

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No. 2: THE ALPS

21677

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THE ALPS

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The main body of the Central Alps stretches in a semi-circle just beyond the western and northern boundary of Italy. As the Alps send one off-shoot along the eastern shore of the Adriatic, they completely shut in northern Italy from other nations. The Central Alps extend only about 500 miles through Switzerland and Austria, a short distance compared with other great mountain systems in other continents.

But the central position of the Alps, which wedges them in between four of the most powerful nations of Europe, has given them an influence upon human affairs during the last 2500 years, greater than that of any other mountain chain in the world.

The great height of the Alps, from 14,000 to almost 16,000 feet, and their variety of remarkable scenery have attracted travelers more than other higher but more distant mountains. The Alps, too, have been studied more carefully than other mountains by geologists and scientific men from all the countries of Europe, so that the knowledge of them has been a sort of key with which to interpret other mountain systems throughout the world.

For Americans the study of the Alps is of much inter-

est, not only because many thousand Americans visit them yearly and report their wonders, but also because a comparison of the Alps with our own Appalachian and Rocky mountains will show many points of similarity and indirectly give us a much better appreciation of our own mountain regions.

The Alps are much shorter and narrower than our Rocky mountains, and they extend mainly from east to west instead of from north to south. The Appalachian system, extending from Mt. Washington to Lookout Mountain, near Chattanooga, has about twice the length of the Alps from the Maritime Alps where they touch the Mediterranean. The Appalachians are also a much broader system than the Alps proper, and only about one-third as high.

The western highlands of North America, extending from Alaska to Nicaragua, are about ten times the length of the main Alps, and spread out to a width of 1,000 miles in the western part of the United States.

Yet Mount Whitney, the highest peak in the United States, is about 800 feet lower than Mount Blanc. The Alaskan Mountains, however, rise to a far greater height than Mount Blanc. Mount McKinley, in Alaska, is 20,464, Orizaba, in Mexico, 18,314 ft. in elevation. The main chain of the Alps would reach only about half way across the widest part of the western Highlands of the United States.

But there are outlying secondary chains which are somewhat closely connected with the Alps and give a greater extension to the mountain system of central Europe. Just northwest of the Alps are the Jura Mountains, a lower chain of earth folds reaching to the Rhine. Across the valley of the Rhone westward are the Cevennes of Southern France. Stretching southward along the Adriatic into Greece are the Dinaric Alps, and beyond the Danube to the northeast are the Bohemian and Transylvanian Mountains sweeping in a great curve eastward and southward to the lower Danube.

The cause for the Alps being lifted high into the air while other parts of Europe are level plains has excited the curiosity of students of geology. Once in the far distant past, the present Alpine region was a level tract, even lying under the water below sea level. The force that lifted these vast masses of earth and rocks into lofty mountains and supported them for long ages was gigantic almost beyond our power to think.

Usually we explain mountain chains as due to the cooling and shrinking of the interior of the earth so that the outer solid crust has to bend into folds or wrinkles so as to fit closer around the central mass thus reduced in size. In this case geologists explain that the lateral or side pressure would lift parts of the solid crest of the earth into prominence. Probably the place where the earth crust would break and be heaved up into moun-

tains was a weak or thin spot, or a line of such weakness. If this theory is correct the broad flat plains are those blocks of the earth's crust which are unusually thick and solid, and by pressing in upon both sides lift some weaker part of the earth's crust into mountain ridges.

The central masses of the Alpine ridges are very hard granite, called also gneiss and protogine. That is, they are not stratified rocks such as we often see in hillsides, as limestone, sandstone and shale, but much harder rock which was formed under great pressure far under the crust of the earth. Mount Blanc and the high ridges of the Alps consist of this very firm and durable rock material which is much harder than the stratified rocks of which the outer crust of the earth is usually formed.

The question quickly arises, what has become of the thick earth-crust that once covered these Alpine rocks and buried them deep under the surface? It is firmly believed that the Alps were once nearly twice as high as they are now, and that the upper half consisted chiefly of the thick earth crust of stratified rocks. It seems more extravagant than a fairy tale to say that probably a thickness of 12,000 feet of rocks has been stripped off from the Alps, that gradual decay and weathering, and the action of water and ice, have worn down these mountains to their present form. It may be, indeed, that the upper rocks were worn down gradually as the mountain ridge was slowly raised during long ages.

Two, at least, of the reasons assigned for believing that the Alps were once covered by the thick crust of the earth may be briefly given. (1) Much of the rock waste that has been carried down from the Alps is found on the lower slopes of the Alps and upon the plains that spread out below them. (2) The old earth crust of stratified rocks reaches up to the Alps on both sides and is tipped up as if it once extended over the whole mass. There is, indeed, much confusion and mixture of these materials at the foot of the Alps, but geologists have examined and studied the rocks and accumulations in hills and along river valleys, and while much is not clear, the above conclusions seem to be generally agreed upon. (3) In passing over the Alps from the uplands of Switzerland on the north to the valley of the Po on the south a cross-section of the mountain ridge would be simply illustrated by a diagram, as follows:

A—Northern Switzerland. B—The Valais. C—Plain of the Po.

From this simple diagram we may notice that the Central Alps consist of a double ridge with a pretty deep valley between them, and that the plain of the Po is much lower or nearer the sea level than the plateau of Switzerland. These great central ridges are mainly of granite. Occasionally the ridge rises into great knobs or humps such as Mount Blanc, or other high peaks. It is these central highlands of the Alps which have impressed travelers with their grandeur. Covered with snow and ice, with mighty precipices, even their lower passes have been difficult to cross. Some hardy and experienced mountain climbers have tried to ascend even to the highest summits, often with danger and disaster.

One of the instructive features of the Alps is their effect upon the winds that strike them from the ocean.

The winds that blow across the Mediterranean from Africa are very warm, and in passing over the sea they take up additional moisture. As these moisture-laden winds strike against the cool Alps, and especially as they rise to the cold upper flanks of the mountains, they are greatly chilled. We know that the effect of chilling such winds is to cause them to drop their moisture, in summer as rain, in winter as snow. The result is that the upper Alps are a region of heavy rains and snows.

In crossing over the Apennines and the Valley of the Po, the winds drop a part of their treasure in the form of rains, but the heaviest fall of moisture is upon the

high mountain ridges. Some of the southward sloping valleys of the Alps have the heaviest rainfall in Europe. Rain-bearing winds from the Atlantic and from the north also bring rains to the Alpine uplands, but coming from colder regions they have less tendency to drench the Alps with moisture.

In the Rocky Mountains the winds blow chiefly from the west, bringing moisture from the Pacific ocean. The high Sierra Nevada receives a heavy contribution of rains from the Pacific winds so that these mountains near the Pacific are clothed with very heavy forests. All along the western coast from Northern California to Southern Alaska, the high western slopes are drenched with heavy rains, making it the wettest region in North America. Having passed the Sierra Nevada or Cascade ranges these winds move eastward across the plateaus and drop their remaining moisture upon the higher ridges of the Rockies a thousand miles from the Pacific. The eastern Rockies, therefore, do not receive such a quantity of moisture as the Alps. The prevailing winds do not blow westward from the Mississippi Valley, so that the region just east of the Rockies is an arid belt, almost a desert for lack of rain.

The Appalachian mountains, like the Apennines, are not high enough to interrupt the winds very much, and while they receive a good supply of rain they do not greatly modify the amount of rainfall east or west of them.

From the subjoined map it may be seen that the Upper Rhone River drains the high mountain valley between the two central ridges of the Alps. Except at St. Gothard, which is the real centre of the Alps, where the parallel ridges come together in a central mass, the very centre of this lofty mountain upland is occupied by a valley, that of the Upper Rhone of the west, and that of the Rhine on the east of St. Gothard.

This upper Valley of the Rhone, before it opens into Lake Geneva, is called the Valais, and is one of the most interesting upland mountain valleys of Switzerland. It is an original fold in the mountains, but has been much deepened by glacier and river erosion. On each side of this valley tower the ice- and snow-covered slopes of the great ridges, and many smaller streams flow down from both sides into the main valley. The slopes on the south are forest-clad, while those on the north, being exposed to the southern sun, are dry and barren. The torrents which leap down the mountain sides have channeled out deep gorges, sometimes a thousand feet deep and very narrow, so that the steep rocks tower hundreds of feet above the little streams that flow at the bottom of the dark, narrow canyons. These defiles are so narrow and choked with rocks, or interrupted with falls and rapids, that they are impassable, especially in the spring when storms and melting snows change the small streams into wild torrents.

These little streams carry a vast amount of gravel and sand into the main valley, and often dam up the valley of the Rhone, causing lakes or marshes to be formed above their entrance. At the mouth of one of these lateral streams the gravel and rocks are often piled up in a fan-shaped slope two or three hundred feet high, and on these elevated slopes villages are built above the floods of the larger valley.

In the spring, when the Rhone is swelled with rains from many of these smaller streams, it sweeps down a great quantity of gravel and sand and deposits them at the head of Lake Geneva, forming a broad flat delta, several miles long. Lake Geneva used to extend some miles further up the valley, but is steadily and slowly being filled up by the waste yearly carried down by the Rhone. As this turbid water enters the upper end of the lake it drops its muddy load, and at the lower end of the lake the water emerges clear and pure.

At Martigny the Rhone makes a sharp bend and cuts its way down across the main Alpine ridge to Lake Geneva. This part of the valley is much narrower than the upper part and is called a transverse or cross-valley, where the river has cut a narrow passage through hard rocks.

The upper Rhone Valley is the natural route for roads passing up into the main Alps, and a railroad follows its course up to the Simplon Pass, where it crosses over the

main Alps into Italy. Between 1802 and 1806 Napoleon built a road up the valley and across the Simplon Pass to Italy. An old road, very famous, leads up from Martigny to the St. Bernard Pass across the Alps. At the most difficult part of this pass is the hospice of the monks of St. Bernard, with their famous dogs, so serviceable in the relief of mountain travelers over this route.

At the upper source of the Rhone is a famous glacier, coming down from the higher mountain slopes and pressing its way through a narrow valley to the head of the lower valley of the Rhone. The melting ice from this glacier forms the chief source of the Rhone, and as this is a famous resort for students of glaciers, we may examine it more in detail.

The source of the glacier is found in the broad snowfields that lie upon the highest and coldest slopes, far above the forest limit. The snows of winter collect to a great depth upon the hollow mountain sides. Year after year it grows deeper and deeper, for hundreds of years, till sometimes these snowfields in the sunken parts of the slopes are 1,200 to 1,500 feet deep. This snow settles and hardens until it becomes compact, so that mountain climbers can walk safely upon it.

But as these broad snow masses lie upon sloping mountain sides they slide slowly downward toward the valleys. The further downward they glide the more they are pressed and compacted, until they gradually change into

solid streams of ice. This change of snow into ice is helped by the melting of the snows in summer, and the melting water settles into the snow and freezes. These ice masses naturally glide into the deep valleys and gorges lower down the mountains, and thus the glaciers proper are formed. These great ice streams move so slowly that people formerly did not notice the advance, but closer observation and measurement show that they very slowly but steadily push down through the valleys, scouring out the rocks to a greater depth, and melting off at the lower end as they come to lower and warmer regions. When the ice stream comes to a steep place in the valley it cracks and splits into great chasms, and exhibits sharp pinnacles and hillocks of ice very difficult and dangerous to climb across. From the mountain slopes on either side, however, the Alpine adventurer can look down upon these wonders of the great ice river. Deep cracks and fissures sometimes open in the ice reaching down hundreds of feet, and reckless climbers have sometimes fallen into these cold ice abysses.

In the summer time the warm sun melts the surface and forms little rills, which gather and plunge into these cracks, and the sound of falling water is constantly heard. These waters sometimes hollow out long passages and, descending finally work their way to the lower end of the glacier where they emerge in a strong current. Such is the beginning of the Rhone.

At the lower end of the Rhone glacier is a great arched tunnel, seventy-five or eighty feet high, from which a broad stream bursts forth, forming the source of the upper Rhone.

The snow fields which feed the glaciers lie on the upper mountain sides from eight to fourteen thousand feet above sea level. The great glacial streams themselves push down the valleys till their lower front is perhaps three or four thousand feet above the sea. But as they reach the lower levels they melt away in these sunny, warmer regions, and their icy waters are carried down the valley. The glacial streams as they emerge from the foot of the glacier are white or turbid, and are sometimes called glacial milk.

As can be easily seen from the pictures, the great glaciers wind their courses through deep valleys and the long, sometimes steep slopes which border them, often send down swift avalanches of snow and ice. These carry with them rocks and gravel. In the spring time, when the snows are melting, and the rocks are loosening along the steep slopes, the visitor to one of these valleys can often hear the thunder of the crashing avalanches and can see them in their swift descent. Loosened rocks tumble down the slopes and are heaped up along the outer edge of the glacier. These rocks, resting upon the ice, are carried down the valley by the slowly-moving glacier. "To appreciate the importance of avalanches one must

ascend the mountains in a warm day in spring. From every cliff, in every gorge, we hear them thundering down all around us. They descend on all sides like hundreds of waterfalls, sometimes in a silver thread, sometimes like a broad cataract. The mountain seems to be shaking off its mantle of snow." (Sir John Lubbock.)

A glacier, like a stream, has branches, and when two glacial streams come together, their inner lines of rocks unite and form a high ridge of rocks stretching down through the center of the combined glaciers. These rough rock ridges are sometimes a hundred and more feet in height. The rock ridges along the outer edges of a glacier are called lateral moraines, those lying in the middle portion, medial moraines. The glacier also scours its own channel along the bottom and all this rock material, gravel and sand is finally piled up at the front of the glacier where the ice melts. In this way huge ridges of rock material, called terminal or end moraines, are built up. From the size of these terminal moraines we can judge what a vast amount of rock and boulder has been torn away and carried down to the lower valleys by the glacier.

Taking the Alps as a whole, a large wall of snow and ice is swept down into the valleys by the avalanches. The upper mountain slopes are thus somewhat cleared of their snow, while the glaciers receive an immense contribution of snow and rock material.

Besides the Rhone glacier there are other large and famous glaciers descending into the Valais. One of these, the Aletsch glacier, is the greatest of all Swiss glaciers. It is fifteen miles in length and covers fifty square miles. These vast snow fields stretching up the sides of the surrounding mountains combine at their lower ends at what is known as the Concordia Platz. As the ice stream winds down through the gorge, it dams up one of the tributary valleys, forming a lake, the Merjelin See. "The side of the glacier forms a cliff 150 feet in height, and rising some fifty feet above the level of the Merjelin See. From the cliff great masses are detached from time to time, which float as miniature icebergs in the lake."

The higher mountain slopes, both north and south of the Valais, are clothed with snow fields and glaciers. Beyond the highest crest, southward, some of the glaciers descend into the Italian Lakes and the Po. On the north side of the Valais, beyond the highest crests, the ice streams descend northward into Switzerland from the Bernese Oberland.

One of the best-known of all the glaciers is the Mere de Glace, which descends from the snow fields from the sides of Mont Blanc, and pushes its lower front down into the famous valley of Chamouni. The Vale of Chamouni, with Mont Blanc and the glaciers, is much visited by the tourists. The upper Rhine valley also has its glaciers, and many are found in the Austrian Alps east of

Switzerland. In all it is estimated that there are from 1,500 to 2,000 glaciers in the Alps, including many lesser ones that have but a small area. By a study of the terminal and lateral moraines distributed along the valleys and mountain slopes, we are able to trace the history of much longer glaciers which once filled the Alpine Valleys.

In former times the Alpine glaciers extended much farther toward the lowlands than at present. The climate must have been colder than now, so that the ice did not melt away as today. The Rhone glacier, as shown by the moraines scattered along its course, once extended westward and filled the whole valley of the Valais. It even filled up the present Lake Geneva, and extended far down the Rhone Valley, beyond the present city of Lyons. Such an ice stream as that, more than 200 miles long, would make the present glaciers in the Alps seem very small, mere remnants.

This ancient glacier, extending hundreds of miles down the valley, has left its marks on the mountains and valleys so distinctly that we can not doubt its former great size and extent. As it retreated up the valley it left a series of terminal moraines which marked its stopping points from time to time. Up along the sides of the valley are also long ridges of rocks left along the slopes (the lateral moraines).

Besides this the whole valley is scoured smooth with the passage of the glacier. At the abrupt turn of the val-

ley, at Martigny, the scouring work of the glacier is specially marked, smoothing out the surface of the hard rocks, and rounding out the mountain. The tremendous weight and power of the glacier as it turned this sharp bend into the transverse valley at Martigny, gives one of the best illustrations in the Alps of the erosive energy of the ice river. The present small glaciers that reach down from both sides, part way to the Valais, are the feeble relics of the vast ice stream that once scoured its long and tortuous course more than half way to the sea.

A similar ice river once filled the upper valley of the Rhine, and the Lake of Constance. Other great ice streams reached down the Reuss from the Alps northward across Switzerland to the Rhine, filling up such lakes as Lucerne, Neuchatel, Thun, and Zurich. The moraines heaped up in hills and ridges across these valleys are certain proofs of such glaciers, and the long lines of rocks far up on the mountain slopes, left there by the glaciers, indicate how high the ice once filled up these valleys and reached along the slopes.

On the south side of the Alps the valleys sloping toward Italy were also filled with large glaciers. Indeed, since the Italian slopes are steeper and longer than those in the Valais, and on account of their greater exposure to the warm southern sun, the Italian glaciers moved down more rapidly and piled up huge quantities of rock and gravel in the end moraines. Some of the old mo-

raines which form circles at the foot of the Italian valleys are a thousand feet high, almost mountains. In one or two cases the lower end of an Italian valley has been dammed up by a moraine 1,500 feet high. Some of the lakes of Italy, and of Switzerland, were formed by damming up river valleys with the high terminal moraines which formed great embankments in the upper valleys behind which the waters collected into lakes.

These huge quantities of rock materials that have been carried down from the high Alps help us to appreciate how the great mountain masses have been worn down in the course of ages, in short, how vast thicknesses of rock layers have been stripped off and carried to lower levels. The period when these vast ice streams scored the mountain sides from the Central Alps in all directions is known as the glacial period. It was a time when snow and ice ruled throughout all this region. A similar ice age can be traced by its results in many parts of North America.

In our previous study of the United States and North America we have probably had some reference to glaciers in the Rocky Mountains. Mt. Shasta, in northern California, has five small glaciers which spring from snow fields upon the northern and eastern flanks. The Pacific Ocean nearby sends rain-bearing winds which deposit their snows upon this mountain, rising more than 14,000 feet above the sea. Farther north, Mount Rainier, in Washington, like Shasta an extinct volcano,

carries still larger snowfields, which descend lower upon the mountain sides before they find warmer regions in which they melt away. In southern Alaska, where the lofty mountains dip their feet into the Pacific Ocean, the glaciers glide down the deep valleys and finally reach the sea shore, where great masses of ice break off from the front of the glacier and tumble into the sea, floating away as icebergs. The reasons for this are that these high mountains are drenched with storms from the Pacific, and vast glaciers, much longer and larger than those in the Alps, are formed and descend the mountains in a cold climate where they cannot melt before reaching the sea. Some of these Alaskan glaciers are sixty miles in length and of vast size.

If we travel southward along the Rocky Mountains into Mexico, we shall find that the lofty volcanoes on the Plateau of Mexico are also clad with snow fields and ice, but in a warm climate they melt far up the mountain sides. Even the high Andes of Ecuador, South America, directly under the equator, have glaciers on their upper sides, but they melt away at a height of 12,000 feet. If we go southward along the Andes, we find that the glaciers descend lower and lower, till in the extreme south, as in Alaska, they reach the coast and send icebergs into the sea. In other words, this longest mountain chain in the world, reaching, in the Rockies and Andes, from the Arctic Ocean across the equator to the Antarctic,

shows the exact influence of high mountains upon snow fields and glaciers in every zone.

In earlier studies we have also learned that Greenland is a country of snow fields and glaciers. In fact, Greenland has some of the most extensive snow fields and glaciers in the world today. The high interior of Greenland is one vast snow field hundreds of feet deep, and as it slowly moves downward to the western coast, glaciers are formed, which push their way through the deep rocky valleys to the sea, and huge icebergs break off and float away southward. The cold ocean current, flowing south from Davis Strait, carries these icebergs down past Newfoundland into the track of the great ocean steamers from the United States to England and Europe, sometimes causing disasters.

The greatest of all glaciers in North America was the vast ice sheet which, as we have formerly learned, reached down from Canada and completely covered the Great Lakes and all the northern States east of the Mississippi, and even westward to the Dakotas. As the climate grew warmer and slowly the glacier retreated northward, it left mighty evidences of its former grandeur in the vast beds of gravel and sand and the long lines of hills and ridges (terminal moraines) behind which thousands of smaller and larger lakes were formed in New England, New York, Michigan, Minnesota, and other states further south. The beautiful lakes of New England, which, like those of Switzerland, are the delight of summer visitors,

occupy the basins formed by the deposits of the retreating glacier. Among the long finger lakes of Central New York are formed numerous terminal moraines, blocking up the valleys, or piled up in irregular hillocks one or two hundred feet in height. In Minnesota and Wisconsin are ten thousand small lakes scattered among the ridges and mounds formed by the melting ice sheet.

Lake Geneva, into which the Upper Rhone flows, is forty-five miles long and eight miles wide in the broadest part. It has in places a depth of 1,000 feet, and its clear, blue waters, reflecting the surrounding mountains, are greatly admired for their brilliancy. It is crescent-shaped, and before the delta at its upper end was built, it formed almost a half circle.

There has been much discussion among geologists how this lake originated. Formerly it was supposed that the great glacier that filled all this valley, with its enormous weight, scooped out the softer rocks and shaped the basin in which the lake lies. The outlet of the lake at Geneva is over solid rock, so that the lake is not formed by a glacial moraine. It is a true rock basin. A closer study, however, of the mountains surrounding the lake shows that the land has been elevated near the outlet at Geneva, and the waters thus dammed up in the old river valley forming the lake. The old beach levels on the mountain sides around the lake, which must once have been horizontal, now slope downward toward the eastern end of

the lake, showing either that the eastern end of the lake has been depressed or the western end elevated. It is indeed probable that the Central Alps in the upper part of the Rhone Valley were once much more elevated than now, and have sunk down. This tipping of the river valley in the opposite direction has converted it for many miles into a deep and beautiful lake. The same thing has happened at Lake Lucerne and Lake Constance, and in several other Swiss lakes. In each case an old river valley has had its slope inverted by tilting, and a lake has been formed. In fact, the same thing has happened in the United States. Lake Ontario is probably the valley of a river whose eastern end has been lifted up more than 500 feet. The old beach levels of this lake, once horizontal, are now between 500 and 600 feet higher at the northeastern end of the lake than at the west.

When the spring floods descend from the upper Rhone they are spread out over the broad surfaces of the lake which serves as a great basin or reservoir, from which the waters are then passed out gradually. The lake therefore prevents great floods upon the lower river. At Geneva the outflowing Rhone supplies a valuable water power which, on account of the large amount of reserve water in the lake, is steady and reliable. A similar important water power is developed at the cities which are located at the outlet of Lake Constance, Lake Lucerne, and others.

All the Swiss Lakes furnish great reservoirs for storage of the waters of the mountain streams, as Neuchatel, Constance, Thun, Zurich, Lucerne, and others. Nearly all the mountain streams that flow into the Upper Rhine are fortunately supplied with these lake reservoirs, which are thus a great protection against floods along the middle Rhine from Basle northward. The same thing is true (on a grand scale) with the Great Lakes of the St. Lawrence. The lower St. Lawrence has no floods, since the Great Lakes serve as reservoirs for the surplus waters. The Upper Mississippi and the Ohio, which have no large lakes as reservoirs for storage of waters, are afflicted with destructive floods. In the Ohio Valley at Cincinnati, and at other points, the river sometimes rises sixty and more feet, causing much damage to cities and fields. The United States government has made surveys of the upper waters of the Ohio and of its tributaries with an idea of establishing great reservoirs which would to some extent hold back the flooded waters, but there are found few good sites for reservoirs, and the expense of building dams would be great.

The wonderful beauty of shore and mountain scenery surrounding Lake Geneva has led to the constructing of broad highways leading to commanding views along its shores. Hotels for visitors and tourists are located at interesting points. A railroad has been built to the mountain top at the east end, and the cities of Geneva and Lau-

sanne are the resort of many visitors. In its charming position at the lower end of the lake, Geneva has been described as one of the three most beautiful cities in Europe. The castle of Chillon, in connection with Byron's poem, The Prisoner of Chillon, has centered a remarkable interest upon this spot of the lake shore. In a dungeon of this castle was imprisoned Bonnivard, the Swiss patriot.

The central point of the Alps is the St. Gothard Pass. From the Central mountain mass several rivers of Europe begin their long courses to the different seas. The Po toward the southward, the Rhone to the west and south, have short courses to the Adriatic and the Mediterranean. The Rhine has a much longer course through Germany and Holland to the North Sea (860 miles). The Danube travels 2,000 miles through several nations speaking different languages, to the Black Sea. Not one of these rivers, however, flows directly into the ocean. The largest river of Europe does not rise in the Alps, but in the great central plain of Russia, while other large rivers of Russia likewise start from low watersheds.

A study of the Yellowstone Park region in the Rocky Mountains shows that here also is the centre of the chief rivers of the continent: the Colorado flowing west and southwest to the Pacific and Gulf of California, the Missouri and its tributaries flowing southeast to the Gulf. Unlike the Alps, the chief centre of the Rocky Mountains is 1,000 miles from the sea, and all its rivers, therefore,

have long courses; the Missouri, in fact, the longest of any river in the world. The St. Lawrence, like the Volga, does not rise in the mountains, but in the Great Central Plain. The Rocky Mountains are so much longer than the Alps that several other great rivers drain their northern and southern extensions, as the Rio Grande, the Fraser, the Yukon, and the Mackenzie.

One of the attractive centres for travelers and sightseers in Switzerland is the Lake Lucerne region. This famous lake,—with its delightful steamboat excursions, its lofty mountains rising often sheer from the water, its cities and beautiful Swiss villages fringing its shores, its smooth and solid roads skirting the lake and rising along the mountain sides, its many hotels and mountain views for the delight of tourists, and, perhaps, most of all, its renowned legend of William Tell and his exploits—this lake furnishes a combination of interests scarcely found elsewhere. The lake itself is so irregular as to be difficult even for a map maker to sketch. It lies close to the mountain centre of Switzerland, and is surrounded by the four forest cantons which, according to tradition, first declared for freedom and established that union of small states which grew into the Republic of Switzerland. According to the Tell story, the first meeting of the freemen to establish the union of the cantons against the tyranny of Austria was held on the Rütli meadow at midnight. This meadow overlooks the Bay

Uri, that part of the upper lake which is likened to a deep mountain gorge. On the other side of this bay is the chapel where Tell leaped ashore in the storm to escape the wrath of Gessler. The Bay of Uri at the upper end of the Lake, hemmed in by steep and lofty mountains, is the particular region made memorable by the exploits of Tell. To the Swiss people and to all who are familiar with Schiller's William Tell, this neighborhood will always have a strong attraction.

Two high neighboring mountains guard the larger part of the lake. Mount Pilate on the south, and the Rigi on the north. Both are commanding summits as seen from Lucerne and from other points on the lake. From their tops, in clear weather, one may obtain a broad view of the great chain of the snow-clad southern Alps which stretch away both to the east and the west. The Rigi is not quite so high as Mount Washington, Mount Pilate is a little higher. From the top of the Rigi eleven smaller lakes beside Lucerne may be seen.

For the comfort of travelers a cogwheel railway has been built to the top of each of these mountains, and from the lake steamer one may reach the station where the little mountain car carries one to the commanding summit of the Rigi. It may happen that clouds and mists encircle the top of Rigi, so that one can see nothing of this far-spreading view, but one must always take the chance on the mountain tops of seeing nothing at all,

for the clouds prefer the summits as much as do the tourists.

Like those of most Swiss lakes, the waters at Lucerne are clear, cold and beautiful, fed from mountain streams which descend from melting snows and glaciers. A voyage of twenty-five miles along the changing, picturesque shores, sometimes clad with forests, now with steep bare rocks, or fringed with strikingly attractive villages and hotels, is one of the chief delights of Swiss travel. But perhaps even more exhilarating is a journey over the well-built carriage roads which wind along the rocky and wooded mountain sides, giving romantic views of the placid or ruffled waters below, and of towering mountain beyond. Chief among these roads is the much-talked-of *Axenstrasse,* which is partly cut through the solid rock and gives such a feeling of ease and comfort while one moves past the grand scenery of lake and mountain. It skirts the rocky ridges far above the lake, and from high points exposes the best views. This great highway leads along the rocky cliffs of the Bay of Urì and up the Valley of the Reuss to the St. Gothard pass, and descends into the warm and luxuriant valleys and lakes of northern Italy. In truth, we are here upon the great highway which has long connected central Switzerland with the Po Valley.

Such roads as the Axenstrasse cost a mint of money, but they are a good investment. It is the delight of moun-

tain travel over such noble and well-kept roads that induces so many tens of thousands in the summer time to visit these regions. Switzerland is not rich in gold and silver mines, as are the mountains of Colorado and California, but indirectly they produce perhaps as much gold and silver as some of our western states. More than 500,000 people a year cross Lake Lucerne and spend more or less time visiting and traveling in these regions of delight. Bayard Taylor, in "Views Afoot," gives a description of his journey on foot across the St. Gothard pass into Italy as follows: "Leaving Amstegg, I passed the whole day among snowy, sky-piercing Alps, torrents, chasms and clouds. The clouds appeared to be breaking up as we set out, and the white top of the Reussberg was now and then visible in the sky. Just above the village are the remains of Zwing Uri, the castle begun by the tyrant Gessler for the complete subjugation of the canton. Following the Reuss up through a narrow valley, we passed the Bristenstock, which lifts its jagged crags nine thousand feet in the air, while on the other side stand the snowy summits which lean toward the Rhone glacier and St. Gothard. From the deep glen where the Reuss foamed down toward the Lake of the Forest Cantons the mountains rose with a majestic sweep so far into the sky that the brain grew almost dizzy in following their outlines. Woods, chalets and slopes of herbage covered their bases, where the mountain-cattle and goats were

browsing, while the herd-boys sang their native melodies or woke the ringing echoes with the loud, sweet sounds of their wooden horns. Higher up the sides were broken into crags and covered with stunted pines; then succeeded a belt of bare rock with a little snow lying in the crevices, and the summits of dazzling white looked out from the clouds nearly three-fourths the height of the zenith. Sometimes, when the vale was filled with clouds, it was startling to see them parting around a solitary summit apparently isolated in the air at an immense height, for the mountain to which it belonged was hidden to the very base.

"The road passed from one side of the valley to the other, crossing the Reuss on bridges sometimes ninety feet high. After three or four hours' walking, we reached a frightful pass called the Schollenen. So narrow is the defile that before reaching it the road seemed to enter directly into the mountain. Precipices a thousand feet high tower above, and the stream roars and boils in the black depths below. The road is a wonder of art; it winds around the edge of horrible chasms or is carried on lofty arches across, with sometimes a hold apparently so frail that one involuntarily shudders. At a place called the Devil's Bridge the Reuss leaps about seventy feet in three or four cascades, sending up continually a cloud of spray, while a wind, created by the fall, blows and whirls around with a force that nearly lifts one from his feet.

"Beyond the Devil's Bridge the mountains which nearly touched before interlock into each other, and a tunnel three hundred and seventy-five feet long leads through the rock into the vale of Urseren, surrounded by the Upper Alps. The little town of Andermatt lies in the middle of this valley, which, with the peaks around, is covered with short yellowish-brown grass. We met near Amstegg a little Italian boy walking home from Germany, quite alone and without money, for we saw him give his last kreutzer to a blind beggar along the road. We therefore took him with us, as he was afraid to cross the St. Gothard alone.

After refreshing ourselves at Andermatt, we started, five in number, including a German student, for the St. Gothard. Behind the village Hospiz, which stands at the bottom of the valley leading to Realp and the Furca Pass, the way commences, winding backward and forward, higher and higher, through a valley covered with rocks, with the mighty summits of the Alps around, untenanted save by the chamois and mountain-eagle. Not a tree was to be seen. The sides of the mountains were covered with loose rocks waiting for the next torrent to wash them down, and the tops were robed in eternal snow. A thick cloud rolled down over us as we went on, following the diminishing brooks to their snowy source in the peak of St. Gothard. We cut off the bends of the road by footpaths up the rocks, which we ascended in single

file, one of the Americans going ahead, and the little Pietro with his staff and bundle bringing up the rear. The rarified air we breathed seven thousand feet above the sea was like exhilarating gas. We felt no fatigue, but ran and shouted and threw snowballs in the middle of August.

"After three hours' walk we reached the two clear and silent lakes which send their waters to the Adriatic and the North Sea. Here, as we look down on the Italian side, the sky became clear; we saw the top of St. Gothard many thousand feet above, and, stretching to the south, the summits of the mountains which guard the vales of the Ticino and the Adda. The former monastery has been turned into an inn; there is, however, a kind of church attached, attended by a single monk. It was so cold that, although late, we determined to descend to the first village. The Italian side is very steep, and the road —called the Via Trinola—is like a thread dropped down and constantly doubling back upon itself. The deep chasms were filled with snow, although exposed to the full force of the sun, and for a long distance there was scarcely a sign of vegetation.

"We thought, as we went down, that every step was bringing us nearer to a sunnier land—that the glories of Italy, which had so long lain in the airy background of the future, would soon spread themselves before us in their real or imagined beauty. Reaching at dusk the last

height above the vale of Ticino, we saw the little village of Airolo, with its musical name, lying in a hollow of the mountains. A few minutes of leaping, sliding and rolling took us down the grassy declivity, and we found we had descended from the top in an hour and a half, although the distance by the road is nine miles. I need not say how glad we were to relieve our trembling knees and exhausted limbs."

Even in our own country we have some spots that might be recalled in connection with Lake Lucerne. In the neighborhood of Mount Washington is Lake Winnepesaukee, also much frequented by outing parties in summer. Lake George, in the Adirondacks, might also be favorably compared with the Swiss Lakes. In the Yellowstone Park are the lake, and still more famous springs, falls and geysers, not equaled by anything in the Alps. Along the Sierra Nevada are several remarkable lakes, hemmed in by high peaks and ridges, as Mono, Tahoe, Chelan, and several others.

One of the large lakes of Switzerland we have already described, Geneva, but others, as Constance, Thun, Brienz, Zurich, Neuchatel, and the Italian Lakes, are also similar centres of beauty and summer pleasure for people from many lands. On the whole, the Alpine lakes are probably the most visited, because they are the most attractive lake region in the world. The outlet of each important lake is the natural location of a city, as Lucerne

on Lake Lucerne, Geneva on Lake Geneva, Constance on Lake Constance, Neuchatel on Lake Neuchatel, Zurich on Lake Zurich, and Zug on Lake Zug. These river valleys and lakes furnish the best routes of travel both for commercial and tourist purposes through these mountain regions.

Besides the great highway for carriages over the St. Gothard Pass, the great Trans-Alpine railway leads from the shores of Lake Lucerne up through the narrow, crooked gorge of the Reuss to the central pass, and down the valley of the Ticino into the plain of the Po. The railroad engineers had a new task to perform where they attempted to build a modern railway up a winding mountain gorge. The gorge was spanned with many a solid stone bridge or lofty viaduct with towering stone pillars. Great circular loops were tunneled through the granite cliffs, and finally, the main ridge of the central Alps was bored through with a tunnel nine and one-half miles long, above which the mountain rose 6,000 feet. The tunnel was driven in from both sides, and the workmen at last met in the centre of the mountain. The highest point in the tunnel is 3,786 feet above the sea, while the St. Gothard pass through which the great carriage road leads, is 6,935 feet in height.

An equal or greater engineering skill was needed in descending the Italian Alps, for the descent is longer and steeper toward the south. Besides the main St.

Gothard tunnel, fifty-five lesser tunnels through the solid granite were drilled and blasted out, and more than twenty-five additional miles of such rock-hewn passages were necessary in getting the road across the Alps. The chief terminus of this railroad on the north is Zurich, and in the Italian Plain is Milan. Since 1880 this road has been the chief line of traffic between Switzerland and Italy, and a large amount of freight is carried both ways. But even the heavy railroad trains seem like playthings as they creep along the narrow tracks and over the torrents at the foot of these giant mountains. All man's greatest works seem small beside the majesty of the Alps.

Several railroads now cross the Alps. First was that connecting France and Italy via the Mont Cenis Tunnel in the Southern Alps. Recently the tunnel across the Simplon has been completed, and is thirteen miles long. It connects Geneva along Lake Geneva and the Valais with Italy, and is the greatest achievement in railroad tunneling in the world. Another railroad connects Austria with Italy. So that it may be said that man has finally completely conquered the Alps with railroads.

The roads across the Alps have been of great importance for more than 2,000 years. Hannibal with an army crossed the Alps and descended into Italy, where he defeated the Romans in great battles. In the olden time the Cimbri and the Teutons descended the Alps and laid waste Italy. During the middle ages many an army

crossed the Alps from Germany into Italy. Napoleon, during his great rule in France, built over the Cenis route a fine military road across the Alps, and this was looked upon as one of his great works.

Two of the most important events in the history of our own country were the building of the Pennsylvania Railroad across the Allegheny Mountains, and later, the construction of the Union Pacific across the Rocky Mountains. As in the Alps, the first mountain railroads were built by the government. Tunnels were put through the Eastern Rockies, the Wasatch Range, and the ridge of the Sierra Nevada. But in the Rocky Mountains the distance was nearly 1,000 miles, while in the Alps it was but a hundred or less.

The first great railroad tunnel undertaken in the world was the Hoosac, through the mountains of Western Massachusetts, five miles in length. This became a model for railroad tunnels in America and Europe, and the machines and processes invented and employed in boring the Hoosac were used elsewhere. It was completed, however, after the completion of the Mt. Cenis tunnel. Railroad tunnels have become very common now in all civilized lands. Even in the less mountainous part of the United States they are often found.

The natural mineral resources of the Alps mountains are few, and in no way striking. The precious minerals are almost wholly lacking. Coal is not mined,

and other metals are but little produced. Building materials, of course, are found in abundance.

The chief natural product of the Alps is the forests which cover about one-third of Switzerland, and yield lumber in large measure. Sawmills are common, and the materials for building and wood manufactures are abundant. The water power furnished by the falls and mountain streams is very important in the manufactures, as at Geneva, at Constance, and the falls of the Rhine at Shaffhausen.

Salt mines have been worked at Bix on the Upper Rhone.

The pastures of Switzerland for the cattle and sheep have long been famous, and the Alpine herdsman with his flocks is an interesting figure. Ascending the mountain slopes to the higher pastures in midsummer and retreating toward the lower valleys as winter approaches. On account of the pastures, the dairy business, with butter and cheese-making, has given the Swiss a high repute.

But the Alps region, as compared with the Allegheny Mountains or with the Rocky Mountains, is singularly poor in mineral and metal products. The wealth of the Appalachian Highlands in coal, iron, and other mineral products is almost boundless, and these resources have given rise to some of the largest mining and manufacturing industries in America, and, in fact, anywhere.

The very rapid settlement and development of our

Rocky Mountain and Pacific States has been due to the rich deposits of gold, silver, lead, copper, and coal found in many districts over nearly all parts of the great Western Mountains and plateaus of North America. In the early times, as well as now, Mexico was found rich in the precious metals, while the mountains of Alaska and British America have begun in recent years to pour their treasures of gold southward. The entire Rocky Mountain systems, from the ice fields of the north to the tropics, seem to conceal in many localities a wealth of the precious and useful metals, in striking contrast to the Alps.

It is interesting to inquire what has been the more direct influence of the Alps Mountains upon the people of that region.

So far as Switzerland is concerned one effect of the mountains has been to bind together into one nation for many hundreds of years people speaking three different languages. The central plain of Northern Switzerland is inhabited by Germans, and these make up the larger part of the Swiss people. In the southwest, around Lake Geneva, the people are French, while on the Upper South Slope of the Alps, the people are Italians, but belong to Switzerland. One would naturally think that on account of language and blood kinship, the Italian part of Switzerland would join Italy and its government, while Geneva and the French would prefer to be a part of France, and the German Swiss would join the Fatherland. But,

on the contrary, these people, speaking three languages, have long preferred to unite as brothers and form a free and independent state in the valleys of the Alps. This result must be due largely to the influence of the mountains upon the people.

In this connection it is notable that the Swiss people have long been a democratic and liberty-loving people. Their government was a republic before America was discovered. The mountaineers have long been famous for their simplicity of life and love of liberty. In consequence, the mountaineers have held together as one people against being swallowed up by the large surrounding nations. While the story of William Tell and his exploits is regarded as a myth, it still expresses so well the ancient free spirit of the Swiss people, and has been so long cherished by them that it interprets to us the mountain character of its bold and independent race for hundreds of years back.

The little Swiss Cantons around Lake Lucerne which were the centre of the Tell story, became the nucleus of the union of the cantons which grew into the republic of Switzerland, with its twenty-five cantons, with its capital and parliament at Berne. On a small scale the union of the Swiss cantons was like that of the thirteen colonies at the time of the Revolution, and it grew into a larger union, as our thirteen states grew into the United States, with its forty-six different governments, making one whole.

In some respects the people of Switzerland resemble the people of New England. Their country, like New England, was naturally barren, with few mineral resources except stone, with only a scanty agriculture, but with plenty of forests and water power. The Swiss people, like the Yankees, were intelligent and ingenious, and out of a poor country they have made a rich one. They kept up good schools for educating their children. Their skill and intelligence caused them, like the New Englanders, to introduce a large variety of manufactures, as the weaving of silks and laces, the manufacture of watches, jewelry, and many kinds of toys and woodwork. They have been compelled, like the New England people, to ship in raw products for manufacturing, as silk from Italy, metals from abroad, cotton and woolen materials for spinning and weaving. Unlike the New Englanders, they had no access to the sea, so that they could not develop fisheries and ocean commerce. But they had in the natural scenery of their lakes, valleys and mountains, a wonderland, which they managed, at a great expense for roads, paths, and hotels, to fit up for the pleasure and entertainment of travelers from all Europe and the United States. As a consequence, the yearly pilgrimage of money-spending tourists which turns toward Switzerland and the Alps must number one or more millions.

In speaking of the Swiss character, it is worth noting that, though a very small country, Switzerland has given

to the world some of its great men. Calvin, the theologian of Geneva, in the period directly following the Reformation made Geneva one of the most important cities of Europe. Calvin was a Frenchman, but he taught and lectured and built a school and church at Geneva, which has produced more important results in Scotland, England, and the United States than many famous men in these same countries. Our Presbyterian, Baptist, and Congregational churches are largely the offspring of Calvin.

The greatest schoolmaster the world has known, Pestalozzi, was born and lived his whole life in Switzerland. His first famous school was among the mountains about Lake Lucerne, at Stanz, where he took full charge of a school of orphan children. Later he established a school at Iverdun, on Lake Neuchatel. His influence upon the common schools has been great throughout Germany and Europe, and not less important in the United States. In schools and colleges, for the training of teachers, all over the United States, we study the life and writings of Pestalozzi.

Geneva was also the birthplace, and for many years the home, of the greatest writer in France, Rousseau. By some he has been looked upon as the most important writer on education in any country. He wrote in French, but his books, translated into other languages, are used in all countries.

The Swiss people are too small to figure as a great

military nation, like France and Germany. They have, indeed, furnished many men to fight in the armies of other countries, and the Swiss soldiers were noted for bravery, but they have not had much influence upon great wars in Europe. Perhaps it is a greater thing to have furnished strong leaders in religion and education than to have turned out great generals, like Von Moltke, Napoleon and Wellington. One of the most remarkable monuments in Europe is the Lion of Lucerne, which was designed to symbolize the bravery and fidelity of the Swiss guards who defended the French king against the mob of Paris at the time of the French Revolution.

At Zurich is one of the well-known universities of Europe. It is a university where many Americans also have studied, especially American women, because it was one of the first of the great schools of Europe to admit women to higher education.

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SUGGESTIONS FOR HANDLING THE TOPIC ON THE ALPS IN GRAMMAR GRADE CLASSES.

It is proposed to put this pamphlet in the hands of both pupils and teachers in grammar schools and to make it the basis of three or four weeks' study. The difficulties involved in this topic are such as grammar-grade pupils are accustomed to meet.

The Alps study as a whole constitutes a good center of organization for much of the physical geography of Europe. The central Alps, the subordinate ranges in Germany, Austria, France and Italy, the comparison of the Alps with the Pyrenees, the Caucasus and the Scandinavian mountains, together with a survey of the great rivers springing from these mountains, will furnish a good survey of the physical features of western Europe.

The commercial and historical features worked out in connection with the Alps also greatly enrich the general treatment.

In putting this pamphlet in the hands of pupils certain questions are raised. First, how much can the children directly interpret and understand by their own reading. Second, how much explanation and discussion from the teacher's side are necessary in order to secure clear images, and third, how much collateral study of maps, pictures, and reference materials may be introduced to advantage?

In the assignment of definite portions of the pamphlet

for children to master by their own study the teacher should combine rigorous requirements for the mastery and reproduction of such parts in the class, with helpful preliminary explanations in the first assignment of such parts. Definite problems may be stated. For example, What are the proofs that a glacier moves? or, How were the lakes of Switzerland formed? The children should be encouraged to ask definite questions on parts of the description that trouble them.

In clearing up her own images the teacher will find out where the chief difficulties lie. The teacher should use the blackboard freely in illustrative diagrams and drawings, showing the forming of deltas at the upper end of lakes, the tilting of the land to form lake basins, the successive terminal moraines left by the retreating old glaciers. The teacher who can get the children to express freely their own ideas by means of such diagrams and sketches has one good proof of successful work.

This pamphlet does not supply many maps and pictures. But this is unnecessary. The geographical text books in use supply plenty of such material and the available reference books on the Alps and Europe are not difficult to secure. It may be said, however, that the descriptive treatment in the pamphlet, reënforced by the maps and pictures in the standard geographies, will answer for a reasonably complete treatment of this topic.

Where good reference materials are at hand, students,

by careful assignment of references by book and page, may be held to a more original kind of work in reading and reporting upon interesting side topics and thus greatly extend the range of their knowledge. This use of reference materials increases the self-activity of pupils and their power to use books. A list of these references was given at the close.

We will next deal with three points with which teachers have considerable difficulty in elaborating type studies, such as this:

First is the selection of an outline of leading topics. This is provided in the pamphlet itself. But teachers are very slow to recognize its meaning and value even when displayed before them. The leading topics worked out in the pamphlet are as follows:

1. The Central Alps. How they were formed.
2. The rain-bearing winds.
3. The Valais or upland mountain valley.
4. The Rhone Glacier. Glacial period in the Alps. American glaciers.
5. Lake Geneva. Its physical and scenic character.
6. The central point of the Alps, and course of great rivers.
7. Lake Lucerne as a summer resort. William Tell.
8. Bayard Taylor's trip across the Alps.
9. The railroad across the Alps and St. Gothard's tunnel.

10. The mineral resources of the Alps.

11. Influence of the Alps upon the people. Great men.

If each of these topics is grasped clearly as a unit of thought it may form the basis of one or more lessons and should be completely worked over before another topic is broached. These leading topics are in clear contrast to a miscellaneous series of facts. Some central typical object is fully described and this description is then made the basis for a much larger organization of similar and related material. Children should master, organize and reproduce satisfactorily one of these topics before advancing to the next. Each child should keep this outline and memorize it as a basis for final review of the whole subject. It is very difficult to induce teachers to do this systematic, thoroughgoing work, but it is necessary to the proper mastery of the material.

Secondly, the comparisons which are based upon these central topics furnish an opportunity for a superior kind of teaching by the instructor and of thinking by the children, which constitute the chief merits of type study work. Each topic is more or less typical and becomes, by comparisons, the center of a group of similar objects both in Europe and America. Nothing is more striking in such a study as the Alps than the large number of fruitful comparisons it easily supplies, e. g., the Rhone Glacier compared with other glaciers in the Alps and in America.

Lake Geneva and Lake Lucerne compared with other Alpine lakes, with those of New England and the Rockies and with our Great Lakes. The St. Gothard railroad and tunnel compared with others in the Alps and in the mountains of the United States.

These comparisons offer an opportunity to review a large part of our American geography in a way to give new and larger meanings to American topics and also to interpret and group with them similar topics in Europe.

Here is a kind of thoughtful review by comparisons which taxes to the full the thinking power of both teacher and pupils, and at the same time largely if not wholly dispenses with the dry reviews which have long prevailed in geography.

The thoughtful teacher, who has discovered the stimulating power of reviews by comparison, will find many other comparisons besides those here mentioned, e. g., the Valais compared with the Mountain Parks of Colorado, with the Shenandoah valley, with Yosemite valley, Bayard Taylor's trip across the Alps, the pioneers crossing the Rockies and the Sierra Nevada, Lewis and Clark's journey, etc.

In fact, comparisons offer a good teacher the broadest field of originality in thinking and in organizing material. She is bound down to no one's dictation, but has a free chance to think for herself and to urge the children to make use of all their previous geographical information.

Such comparisons have also a rare power of impressing facts upon the memory by reason of striking contrast or similarity, and thus combine and organize large series and groups of facts, so that they can not easily drop out of mind. The association of ideas so much recommended in our psychologies has its supreme opportunity in these comparative reviews.

Third, the organized series of facts worked out in each main topic forms a natural basis for a *review drill* and for that final mastery of the facts which good teachers require. For example, the series of Swiss and Italian lakes, as Geneva, Neuchatel, Thun, Lucerne, Zurich and Constance, north of the Alps, Lakes Garda, etc., in Italy. Next to these the series of New England lakes, the Great Lakes of the St. Lawrence and those of the Rocky Mountains. Such a series rests back upon an idea. It is not a mere enumeration of unconnected objects, but is the outcome of a thought process and indicates the previous thought movement.

One of the objections often raised against type studies is that they do not teach the important customary facts of geography. But where comparisons are properly worked out on the basis of leading topics and the resulting series drilled upon, this criticism loses its point. Indeed, comparisons carried a little too far might easily degenerate into a too exacting memorizing of many facts.

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